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SECURITY INFORMATION

MINISTRY OF SUPPLY

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CHEMICAL DEFENCE EXPERIMENTAL ESTABLISHMENT

PSYCHOLOGICAL EFFECTS OF A G-AGENT ON MEN

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B. CLARKE

PORTON TECHNICAL PAPER No. 322

C.D.E.E.
Porton.
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PORTON TECHNICAL PAPER NO: 322

DATE: 4 MAR [illegible]

PSYCHOLOGICAL EFFECTS OF A G-AGENT ON MEN

Preliminary Report on an exploratory study of the effects of GB vapour on unprotected men, with particular reference to their subsequent performance levels

by

Basil Clarke *

SUMMARY

1. The psychological effects of exposure to GB vapour were studied in an Experimental Group of twenty men by a series of tests. The same tests were used with a Control Group. Clinical observations were also made.

2. The tests were designed to test reasoning capacity, efficiency in a visual search task, rate of learning on an eye-hand co-ordination test, and simple and choice response times to auditory and visual stimuli.

3. No deterioration in central intellectual capacity was found.

4. Efficiency on a visual search task was impaired.

5. The rate of learning a simple eye-hand skill was slower in the experimental group.

6. The rate of improvement in response times slowed after 24 hours. Both auditory and visual responses were affected; and this suggested that something more than the pain of performing visual tasks was operative. When an extra stress involving a conflict over a learned skill was imposed, the performance of the Experimental Group deteriorated sharply compared with that of the Controls. When an extra stress not involving conflict was introduced, this did not happen.

7. The Experimental Group's palmar resistance level failed to show the expected normal rise found in the Controls on re-testing.

8. The usual clinical findings after exposure were observed. The psychological progression was from an initial pseudo-dejection to a state of continued lethargy and disinclination to be bothered, though the men remained basically willing subjects. These effects would have a bearing on military considerations such as individual morale and group-cohesion after exposure.

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INTRODUCTION

1. An attempt was made in 1945 by Curwen and Milner to measure the effects of a G-agent vapour (Tabun) on unprotected men by means of tests "suitable to their occupations". The men, who were infantrymen, staff officers, and civilian scientists, performed such tasks as firing rifles, map-reading, stripping an automatic weapon (infantry), doing slide rule calculations and plotting battle locations (staff officers), or their "normal work" (civilians).

2. The result was a percentage estimate of the harassing effect of the vapour on men doing visual tasks. But the study brought out the difficulties of getting results from which sound and reasonable generalisations could be made of the effects of G-agents on human working efficiency through assessment of the subjects' performance level on their normal occupations. These difficulties spring from insufficient knowledge about (a) variations in the subjects' general ability (intelligence), (b) the varied demands of the many specific military skills (trades), (c) the amount of training different men have been given on any particular skill, and (d) the length, conditions and intensity of their subsequent experience of that skill or trade.

3. One way of meeting such difficulties and simplifying the issue is to set up a special measurable task or series of tasks in a laboratory, to equalise conditions (b), (c), and (d) as far as possible, and with the help of information about (a) from the subjects' military records to watch deterioration of performance after exposure.

4. The present brief study, though begun without knowledge of earlier work, was made with this approach in mind. But as it was exploratory of the wider problem, other psychological aspects than performance changes are described.

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5. In order to make most use of the subjects' services, several kinds of test were packed into the time available, even though this meant that less precision was possible in each part of the study. After a preliminary run, the following standard procedure, which was conditioned by the time and practical facilities available, was repeated with twenty subjects. Further detailed description is given later.

PROCEDURE

6. The twenty volunteer subjects came from the Royal Air Force, in four groups of five. The testing of each group occupied three days, and a new group arrived each week.

7. On the first day in the early afternoon a short group-testing session, using pencil-and-paper tests, was followed by individual performance tests lasting just under half an hour for each man.

8. Early on the second day, each man rested in a chair for ten minutes for a measure of palmar resistance changes to be taken. Then, mid-morning, the men were exposed, wearing oilskins to prevent absorption of the vapour by clothes but with no eye shields or respiratory protection, to GB vapour. The concentration was kept approximately constant for all groups at a level expected to produce mild to moderate harassment only. In the afternoon the first day's tests (except one paper one) were repeated. Although there was some spread, because the whole group took $2\frac{1}{2}$ hours to test, this second testing session is recorded as "5 hours after": it was considered that no changes fast enough to falsify this were occurring.

9. On the third day the programme of the second day was again repeated (except, of course, for the exposure) - the ten minutes resting period first thing in the morning, the last group and individual testing sessions later in the day. This last session is recorded as "24 hours after". At the end, subjects were questioned, and then normal remedial measures were begun at once.

10. Independent routine estimates on a rating scale were also made of the subjects' clinical condition at fixed intervals, and these were recorded.

11. In order to provide control data, a smaller group of men of approximately the same calibre and age was put through the tests elsewhere. Although this group did not experience the full situation (they should strictly have gone through the chamber, exposed to an innocuous vapour, for example), the meaningful base lines they in fact provided justified the concession to administrative convenience.

THE SUBJECTS

Experimental Group

12. The twenty men of the Experimental Group were all aircraftmen in rank, with one instructive exception, a Sergeant, who was the oldest.

13. Age The distribution and average age are shown in Table 1.

TABLE 1

Years	f	
18	1	Average Age =
19	10	20.75 years.
20	2	
22	2	
23	1	
24	3	
28	1	

14. Employment - All the men were employed on ground duties, as follows:

TABLE 2

Clerk	2
Driver	4
Mechanic (various)	6
W/T Operator	2
Orderly	5
Unrecorded	1

15. Intelligence - At the time of writing, the intelligence gradings of these men have not been forthcoming from the Royal Air Force, but it was decided on various grounds that, as a whole, this group was a little higher in the scale than the Control Group. On this assumption the results make good sense, and are so discussed.

16. Motives - The men's reasons for volunteering were not exhaustively probed, but appeared sensible. Most had come for a change and out of a mild curiosity, with the prospect of a small payment as a secondary inducement. The awkwardness of the few references to higher motives - of helping others, etc., was taken as a good sign. One or two noble martyrs had been diverted to other work.

Control Group

17. Ages - The Control Group consisted of eight infantrymen, picked by their unit as being of middle quality. Their ages were:

TABLE 3

Years	f	
19	2	Average Age =
20	1	21.75 years.
21	1	
22	1	
24	2	
25	1	

18. Employment - Six of the men were fighting soldiers, fully trained in infantry weapons; the other two were signals operators.

19. Intelligence - On the Army's 5-grade system of selection grading, the men were distributed as shown (with a correction for an incomplete record):

TABLE 4

Selection Grade	1	2	3+	3-	4	5
Number	-	-	3	3	1	1

20. The groups are comparable in important respects, in age, in skill, and in intelligence, with the qualification already mentioned, even though they are from different Services and would have different functions in war. Three-quarters of the Experimental Group and five out of eight of the Control Group wereon Regular or Short Service engagements, the rest were National Service men.

DESCRIPTION OF TESTS

Classification Test (Reasoning) - Group Test

21. A set of 36 non-verbal classification problems, of the kind used in some intelligence tests as a measure of "g" or general cognitive ability, was given as a group test - a four-minute speeded period was allowed each time. (The sample page will be found in the Appendix). If the exposure has slowed up the central (cerebral) processes of reasoning, it may be presumed that a slower rate of improvement in scores will be evident among the experimental subjects on repeated testing.

Perseveration

22. In some pathological conditions a rise in perseveration is found, that is, a reduced flexibility when rapid switches of mental "set" are required. A card with 60 vari-coloured spots was presented with instructions to touch and name all the red and blue spots (only) as fast as possible for a given period. This was repeated rapidly several times - but on alternate presentations the subject had to reverse the names, i.e., to say "Red" when touching a blue spot and vice versa: the ratio of the two activities is calculated from the numbers of correct namings. Although this is only one sub-test from a battery of six, any big change in the ratio should be an indicator of this kind of flexibility.

Visual Search

23. Part of a test for "K" (spatial-relations ability) was used as a visual search test. In each problem four given small patterns of crosses had to be searched for and found in a continuous band of scattered crosses, and encircled with a pencil line (see Appendix). The score was the number correct: the time the group had was four minutes. Slow improvement should indicate impaired visual efficiency in this kind of activity.

Track Tracer

24. The Cambridge Triple Tester, in which a wheel-controlled pointer is guided along a revolving spiral path of dots, was used as a measure of skill, four runs being made in each individual session. At the end of the last session two extra runs were required with the apparatus adjusted to make the movement of the pointer heavy and stiff. This demanded a quick adjustment of method.

25. An important point needs to be clarified here. It was suggested at the beginning that a laboratory study of this kind should be directed to the effects of exposure on a skill acquired under standard conditions, i.e. to deterioration of skill. But to learn such skills fully as a preliminary takes more time than is available with these volunteers. Attention was therefore directed, not so much to loss on a learned skill, as to the effects on the rate of learning a new skill; this may even be a more sensitive index.

Dotting

26. The McDougall-Schuster spiral dotting machine was employed, partly as a further skill test, but more as an indicator of persistence (or motivation) in the experimental group. A stream of small circles passes a window in a flat lid, and the subject tries to put a pencil dot in every one. The spiral arrangement means that they pass at a constantly increasing speed, so adjusted that at the end all but the most skilful have been reduced to almost random success in hitting the circles. By dividing the stream into sections and counting the successes in each, a work-curve can be plotted, and it can be seen (by sudden falls and recoveries) how a subject's effort has held up, fluctuated, or collapsed. In this case the results for each group were averaged section by section.

Response Times

27. This was a measure of the time taken to respond to discrete stimuli, a kind of atomised test of basic skill. To be exact, it is not quite the same as a reaction time, which is the time required to initiate an effector movement on receiving a stimulus, and is relatively unimprovable. In this case a small finger movement of 8 cm. was included in the required response, and the mean values of the response times on the simple-stimulus trials are approximately twice the reaction times appropriate to the two senses used. There were three parts, and improvement over the three sessions in each part was studied.

28. Part 1. Auditory-Simple The subject depressed a key on hearing a sharp click (the sound of the switch closing the timing circuit). The procedure was, of course, standardised.

Part 2. Light-Simple The subject faced a grey wooden screen, 24" by 21", at a distance of 4 feet. In the centre of the screen a square tube protruded $4\frac{1}{2}$"; its aperture was $1\frac{5}{8}$" square. After a warning light in the top corner of the screen went out a plain square of diffused light appeared in the centre aperture. The subject, depressing his key, cut the light and closed the time circuit.

Part 3. Light-Multiple Choice As the second part, but instead of a plain light a number appeared. The subject now had a bank of five keys in front of him, numbered, and had to choose and depress the right one. (This most complex of the response tests is a complete simple skill). At the end of the last session, a new number-order was put on the keys, as an extra unexpected pressure on the subjects, and more readings taken.

29. Full details of apparatus and procedures are not necessary, but the timing was by an electronic clock measuring in milliseconds; light and clock were started simultaneously by a distant double relay to obviate the sound of a switch; not less than five readings were taken on Parts 1 and 2 (one or two more if the variation was wide) and fifteen on Part 3; the numbers in Part 3 appeared in a random succession.

Palmar Resistance

30. Changes in electrical resistance through the hand have long been studied from various points of view. Psychological interest has been largely in the sudden changes going with emotional states - surprise, fear, and other affectively charged situations - the "psycho-galvanic reflex", as it has come to be called. But attention has also been given to the slower changes. Briefly, the resistance tends to be high in sleep, and lower in states of alertness, alarm ,or apprehension. It will normally rise when a subject sits down to rest. Physiologically, it appears to be related to the degree of general sympathetic activity (an inverse relation) and to the local sweat-gland functioning associated with such activity.

31. In the present case the phenomenon was merely being tentatively explored, to see if it held promise as a method of studying the apprehensiveness that is a frequently reported feature after exposure to G-agents. The apparatus for this purpose was straightforward, not to say crude, namely, a galvanometer, Wheatstone bridge, 4-volt battery, flat copper electrodes (for palm and dorsum) covered in two layers of material and moistened with, respectively, copper sulphate and saline solutions.

32. There is adaptation to the experimental situation (sitting in a chair for ten minutes),so that a normal unexposed group should produce a curve at a higher level on the second than on the first day. The hypothesis is that the exposed group's second-day curve would be below that of the controls. Regarding the results from the psychological point of view, this could plausibly be related to a state of generalised anxiety or apprehension.

Neurotic Questionnaire

33. As a numerical check on the stability of the groups, the first group-testing included a forty-item questionnaire of the kind employed in military psychiatric screening procedures. The numbers being small, it was not expected that the scores would be useful for correlating with the results of other tests, but they were adequate for checking the groups against each other and against the normal-neurotic norms of the test.

RESULTS OF EXPOSURE AND TESTS

A. Dosage and Percentage ChE Inhibition

34. The concentration of GB vapour on the four experimental occasions is shown in Table 5:

TABLE 5

Trial	Dosage (Ct.)	t
1	10.0	1 min. 55 sec.
2	10.3	2 min. 1 sec.
3	10.2	2 min. 0 sec.
4	9.7	2 min. 0 sec.

Average values are Ct. = 10.05, and t = 1 min. 59 sec.

35. The degree of ChE inhibition found in the experimental subjects is shown in the following table, which shows the distribution of percentages:

TABLE 6

Percentage	f	Percentage	f
22	1	33	1
23	1	34	3
27	2	35	1
28	3	36	2
29	2	39	1
32	2	41	1

36. Seven of the first ten fall between 27 - 29%; eight of the second ten fall between 32 - 36%. The average value is 31.4%. There was little relation between the slight variations in concentrations over the trials and the degree of ChE inhibition, nor have links so far been found between the percentages and the results of the psychological tests, or the scores for severity of symptoms.

B. Clinical

37. Symptoms

The physical symptoms were of a typical nature and need not be described exhaustively here, though their progress had a point of interest.

38. In the first hour after exposure there had usually been a slight bronchoconstriction, rhinorrhea (sometimes), frontal headache, and the beginning of the pain at the back of the eyes. These varied with individuals and were not all present in all cases. By the fifth hour the chest

and nose symptoms had tended to abate or disappear, though mild chest tightness recurred intermittently in one or two. One man vomited four times, and two others complained of nausea. But the eye symptoms were the main feature from now on. After twenty-four hours the men's general condition was much the same, but they were more conscious of the eye discomfort, and had the additional effect of a poor night's sleep. Recovery was rapid after treatment at the end of the experiment.

39. The psychological picture was, first, a slow collapse into apparent dejection during the first hour or two. From this state, however, the subjects could easily be roused to normal animation by such events as the routine taking of a blood sample. In some at this stage there was a tendency to giggle or laugh for little reason, but this was thought to be a mild hysterical reaction to the situation itself rather than a G-agent effect. In the afternoon (5 hours) most said they felt a little better, and, though there was lethargy, made an effort on the tests. The next morning there was little change in attitude, though more complaints about the eyes in relation to some of the visual tests.

40. At the end of the experiment they were questioned about their attitude to Sessions II and III (after exposure). Almost without exception they described in various terms a state of not wanting to be bothered with anything, poor concentration, tiredness; there was little change between Session II and Session III. Some care was taken to distinguish this state from boredom at having to repeat the tests. Two said they were a bit bored as well, but most spontaneously explained that it wasn't boredom or resentment and that they were at both sessions quite willing in principle still, but didn't feel up to the effort. Some found the unavoidable waits during testing hard to tolerate.

41. The physical symptoms were checked independently at intervals of ½-hour, 2, 5, 24 hours from exposure, and a rating made on a five-point scale for each type of symptom. Since these ratings were made by two experienced workers working together, their consistency (statistically, "reliability") could be expected to be high; and it was therefore proper to translate these ratings into numbers on a scale from zero to four. This allowed summation and the plotting of progress in severity for the group as a whole. The symptoms checked each time were: Headache, rhinorrhea, chest tightness, nausea, and (the eye effects) miosis, blurring, suffusion, retro-bulbar pain, the blinker effect, and accommodation pain. From Graph 1 it can be seen that the severity of symptoms eased up to five hours, chiefly with the abatement of the non-ophthalmic discomfort, and that the eye symptoms remained or became worse. This progress fits in with observation and with the psychological trends described above. (The graph should not be taken to imply that the peak harassment is at 24 hours. The data do not answer the question: the experiment ended soon after 24 hours, and the peak may have been between 5 and 24, or after 24 hours).

42. Sleep and Dreams

This aspect deserves a separate note. Only two of the twenty reported a good night. The rest all followed a very similar pattern of going to bed early, taking a long time to go to sleep, waking several times, but getting a really sound two or three hours before waking at 7 a.m. Typically, they went to bed an hour and a half earlier than usual because they did not feel well, took about two hours or more to get to

sleep instead of their usual $\frac{1}{4}$ - $\frac{1}{2}$ hour, and woke 4 or 5 times during the night with eye pain. These are averaged values.

43. The dreams reported were of two kinds. One, the anxiety dream, was really just an extension of the restless quality of the night ("tossing and turning") of which most spoke. In the other kind there was, as well, a reaction to the more immediate sensory stimulus of the eye pains (in the way that, for example, an alarm clock has been shown to start a dream including church bells pealing). The dreams encountered are summarised below: the men did not dream much in the ordinary way.

(a) (Anxiety). Several unpleasant fragmentary dreams, especially one of a soldier getting killed - very complicated; was confused on waking. (This was the Sergeant, who also reported a seminal emission during sleep this night).

(b) (Anxiety). He was going home on leave; called for his girl, and was told she'd fallen off her bike and was in hospital.

(c) (Anxiety). A further case reported an extreme and prolonged series of confusedly fearful nightmares, but could not describe the content coherently.

(d) (Eye pain). Dreamt of three big broad needles pointing at his head, which was very sore. Woke in a sweat, and was told he had shouted out.

(e) (Eye pain). He threw a knife at a vulture which was about to molest a smaller bird. He missed; the vulture picked up the knife in its beak and came at him. He then woke up, very sweaty, with "a horrible pain just above the eyelids".

C. Performance Levels

44. The results of the various tests are given in the attached graphs In nearly all, we are studying relative rates and amounts of improvement between the Control and Experimental groups over three sessions on three consecutive days.

45. Reasoning Test and Perseveration (Graph 2). It was decided - see para.15 above - that the Experimental Group was a little more intelligent than the Control Group. In accordance with the known results of practice on such tests, the Experimental Group should in the normal way (a) have a somewhat higher score to begin with, and (b) improve at a slightly better rate. Both these expectations are fulfilled here. We cannot therefore say that there has been a fall-off in the efficiency of the central powers of reasoning themselves.

46. The Perseveration Index would probably rise for the experimental subjects if they are showing blocking on the last test. That it does not do so tends to support the conclusion in para.45, though not strongly: this, as explained in para.22, is not a complete test, only a pointer. These results are not on a graph: the following table shows the means, none of which is significantly separate from the others.

TABLE 7

Mean Perseveration Index

	Session I	Session II	Session III
Exptl. Group	1.43	1.40	1.40
Controls	1.41	1.40	1.42

47. Visual Search (Graph 3). This is a test somewhat on its own, but the activity is an important one militarily, closely allied to the "vigilance" which has been studied elsewhere in connection with the watching of instrument screens; and even this short test was worth including. Graph 3 shows that the Controls, starting with a mean just below the experimental group, improve steadily over the three sessions, and end above them. The experimental subjects level off and fail to maintain a normal improvement; This ability appears impaired by the effects of exposure; repeated accommodation pain from the close scrutiny of a close small pattern may be presumed to be involved.

48. Learning. (1) Track Tracer. (Graph 4). All scores have been reduced to a percentage of original scores, for easy comparison. The Controls improve steadily and well between Session I, Trial 1, and Session III, Trial 4. The Experimental Group fails to rise so high, and improves at a much slower rate. There is a secondary difficulty. It may be seen that the experimental subjects diverge at the end of the first session, i.e., before exposure. Whether in the normal way their rate of improvement would be less than the Controls, or whether the reduced rate at the end of Session I is merely a so-called "plateau of learning", to be followed by a spurt, is not certain. But even though the percentage method slightly favours the Controls, there is little danger here in presuming a lowered rate of learning and performing an eye-hand co-ordination skill.

49. However, under the extra load at the end, the two groups drop comparable amounts, the Controls 14% of their average for the previous four trials, the Experimental Group only 15%.

50. Learning. (2) Response Times. (Graphs 5, 6, 7). Here the margin for learning was narrower; and we are getting closer to a measure of physiological limits.

51. Part 1. Auditory-Simple This was included as a check against the Light responses, where the painful local effects of the exposure might cause an extra diminution of speed. The mean speeds of response for the Controls improve regularly over the three sessions. The others begin to improve, but fall back on the third testing.

52. Part 2. Light-Simple Here the Controls unfortunately acted a little anomalously. Their Session II mean does not improve as much as one would expect. However, the total gain over the three sessions is of the expected order; and even if the dotted line is a too optimistic estimate for a perfect Control Group, the relation to the Experimental Group's

achievement is clearly of the same kind as for the Auditory-Simple. This is interesting. The eye discomfort is not the only factor. Another sense is also affected by sensori-motor blunting between the fifth and twenty-fourth hour after exposure.

53. Part 3. Light - Multiple Choice This simple skill confirms the results of the Track Tracer trials. The Experimental Group improve more slowly than the Controls. (By a convenient coincidence the means on Session I are identical for the two groups). Moreover, when an extra load is imposed without warning at the end, they fall off very sharply compared with the Controls. The Track Tracer "extra load" was simply a call for more effort in the same direction. The Response Test load (changing the number order on the keys) involves more - a conflict between a learnt pattern and a new one: and it seems that it is this kind of load which causes the deterioration.

54. Dotting. (Graph 8) Only the work curves for the first and third sessions are shown, to avoid confusion: the others lie between. On total output, by summing the section scores, the gain for the Controls is 42% (in successful hits at the circles), against the Experimental Group's 37%. A graphical method of estimation gave a similar result. As a skill, then, this result is in conformity with the previous ones. The exposed men do not improve so much, though they have an initial advantage. But as a persistence indicator the picture is different. Although on each run the infantrymen start better, yet in both sessions the exposed men finish more strongly, i.e. are trying hard to the end, both before and after exposure. This suggestion of good motivation supports the observation in the Clinical section above on willingness (para.40).

55. Neurotic Questionnaire It should be mentioned here that the mean scores on the questionnaire were: Controls, M = 8.5; Experimental Group, M = 10.3. The norms for the questionnaire are: Normals' Mean = 7.0; Neurotics' Mean = 21.8. A group average above 15 would be very suspect. Both groups are well within the accepted limit. Perhaps the Controls are a little steadier than the volunteer subjects, but the means are not significantly different.

56. Palmar Resistance. (Graph 9). The lower two lines are the first day's resting session: the upper two are the second day's, and owing to differing individual ranges, the first day's first reading was taken as 100%. (A small adjustment has been made, however. The experimental group's curve fell in the first minute - this is quite usual, while subjects wait apprehensively to see what the experimenter is going to do to them - so Minute 1 of this record is taken as 100: the change is slight).

57. As explained previously, adaptation normally results in a higher curve on the second and subsequent days. Both groups have the same curve on the first day. On the second day (after exposure) the Controls have a much higher curve than the others. It must be admitted at once that it is also much higher than would normally be expected. This may be due to experimental conditions - the Controls were tested elsewhere, and on the second day, owing to a transport breakdown, they had (it was subsequently learned) marched a brisk two miles immediately before the testing. However, the shape of the second day's curve is similar for both groups - a sharper rise at the start, a fall from minute seven, and the beginnings of recovery at the end - whatever these details mean, they suggest at least that both groups were going through the same kind of situation.

If so, the Experimental Group's "apprehensiveness" may be reflected in the lower resistance figures. There seems enough to prompt a study by more accurate apparatus of this effect, to see if there really is anything important in it.

58. A small side experiment on the colour vision of two of the men was tried incidentally, on a hint of a possible shift after exposure. Only a slight general increase in discrimination errors in grading colours was found: one man had a noticeable defect in one area, but it did not shift round the colour circle after exposure.

SUMMARY

59. The above findings may be summarised without further discussion, as this is a preliminary survey.

60. Twenty men were exposed to a GB vapour dosage of Ct. 10. Their performance and rates of improvement on a number of tests 5 and 24 hours after exposure were compared with their showing on the day before exposure, and with the results of a comparably spaced testing of a control group. Clinical observations on their condition were also reported.

61. Normal physical symptoms developed. Their progress over 24 hours was charted on the basis of ratings, and showed a fall in severity to 5 hours, followed by an increase, of eye symptoms chiefly, over the next day. Nearly all men spent a restless night of a particular pattern.

62. Psychologically, an initial pseudo-dejection was followed by a feeling of lethargy and inability to be bothered, even though boredom and resentment were absent and the men were not basically unwilling. (A number of military considerations affecting raised thresholds to stimulation and group-cohesion (morale) arise here and would be important in application).

63. General anxiety dreams and locally stimulated dreams were reported by several men.

64. A test of reasoning did not disclose a deterioration after exposure, in central intellectual capacity.

65. Efficiency on a visual search task was impaired.

66. A slower rate of learning eye-hand skills was demonstrated. An attempt to estimate an overall percentage loss from this data would be premature.

67. Response time improvement slowed after 24 hours. Both auditory and light responses being affected suggested an effect not referable solely to eye symptoms and the pain caused by visual tasks.

68. When an extra stress, involving a conflict over an old learned response, was imposed, the experimental subjects were much put out. This did not happen with an extra stress not involving conflict.

69. Basic motivation in the Experimental Group appeared to be good, even during their period of apparent lethargic disinterest.

70. Palmar resistance results, in spite of reservations about technique, suggested that this might have possibilities for the study of psychological effects, if suitable apparatus were developed.

71. Although all the cross-relations in these results have not yet been worked out, the two main directions sign-posted by this study seem to be (1) the development of a standard scale or scales for expressing loss of efficiency in general terms, and (2) exploring the effects of exposure further by means of conflict situations, i.e. what are known, somewhat misleadingly, as the methods of "experimental neurosis". This would probably involve animal work at various concentrations, however, as a preliminary to devising suitable human trials. But it is certainly relevant to the investigation of the military effects of these agents.

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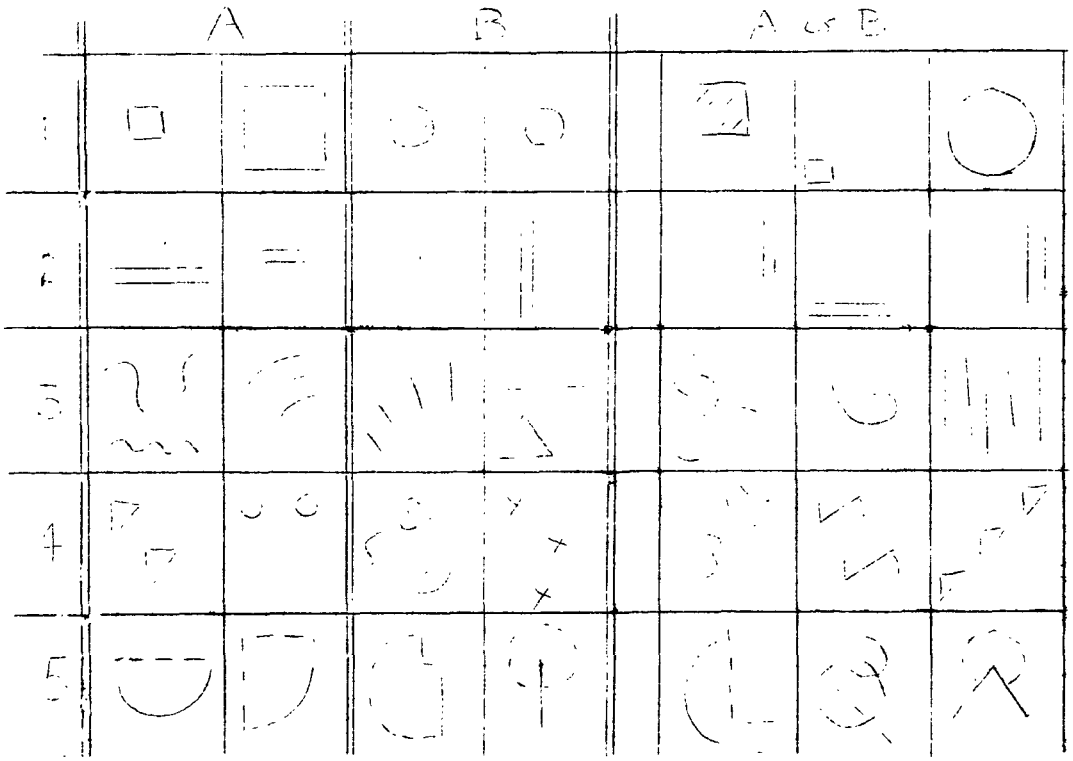
REASONING

PAIRS

Below on the left you will find two columns marked A and B. Look at Question 1. The figures under A are squares; the figures under B are circles. Now look at the three figures on the right. The first is a square, so it belongs to the A group. So does the second. The third is a circle, so it belongs to the B group.

So the answer to question 1 is: A .. A .. B

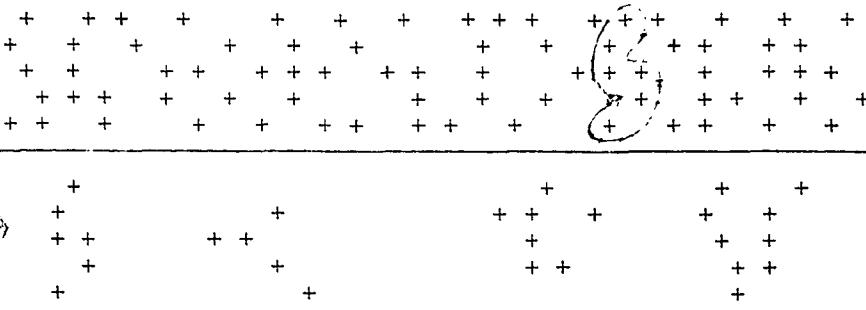
Now try to solve the others on this page the same way. Look at the three figures on the right of each question and decide whether each belongs to the A group or the B group. (Write your answers on the back of the Answer Sheet).



VISUAL SEARCH

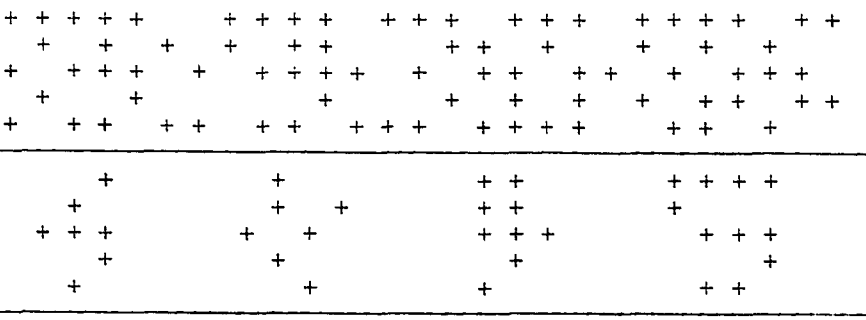
Name _____ K: _____ Serial _____

1



Done for you →

2



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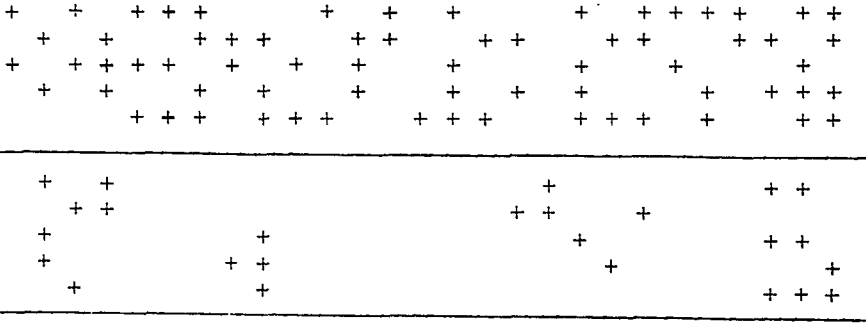

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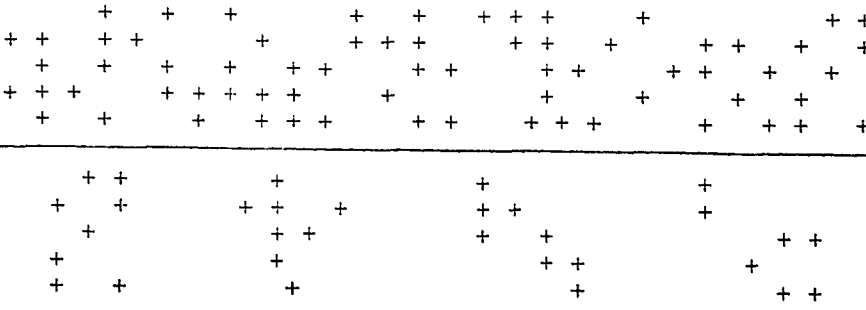

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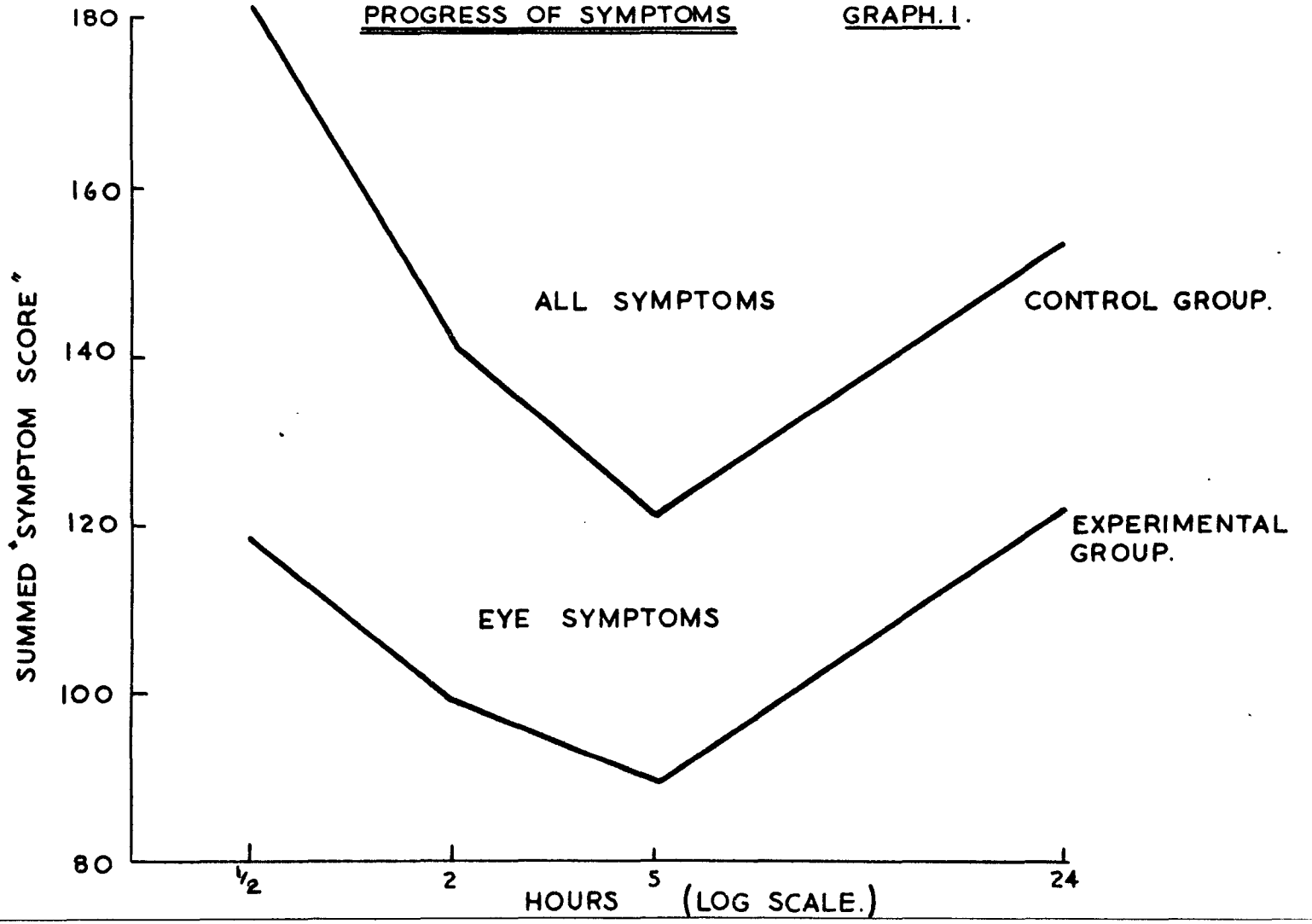
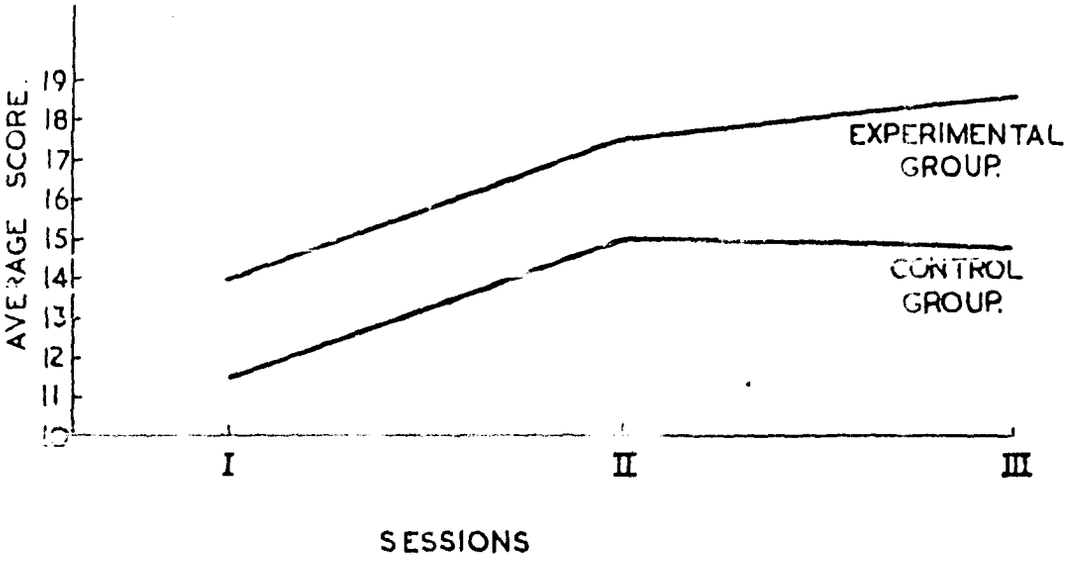
PROGRESS OF SYMPTOMS GRAPH. I.

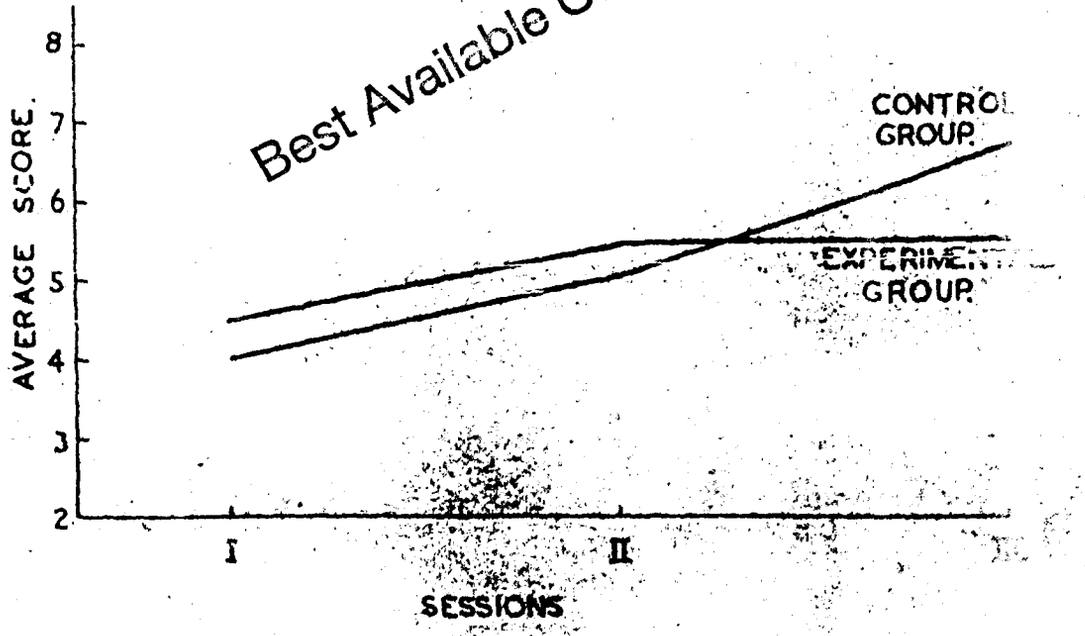


REASONING TEST GRAPH. 2.

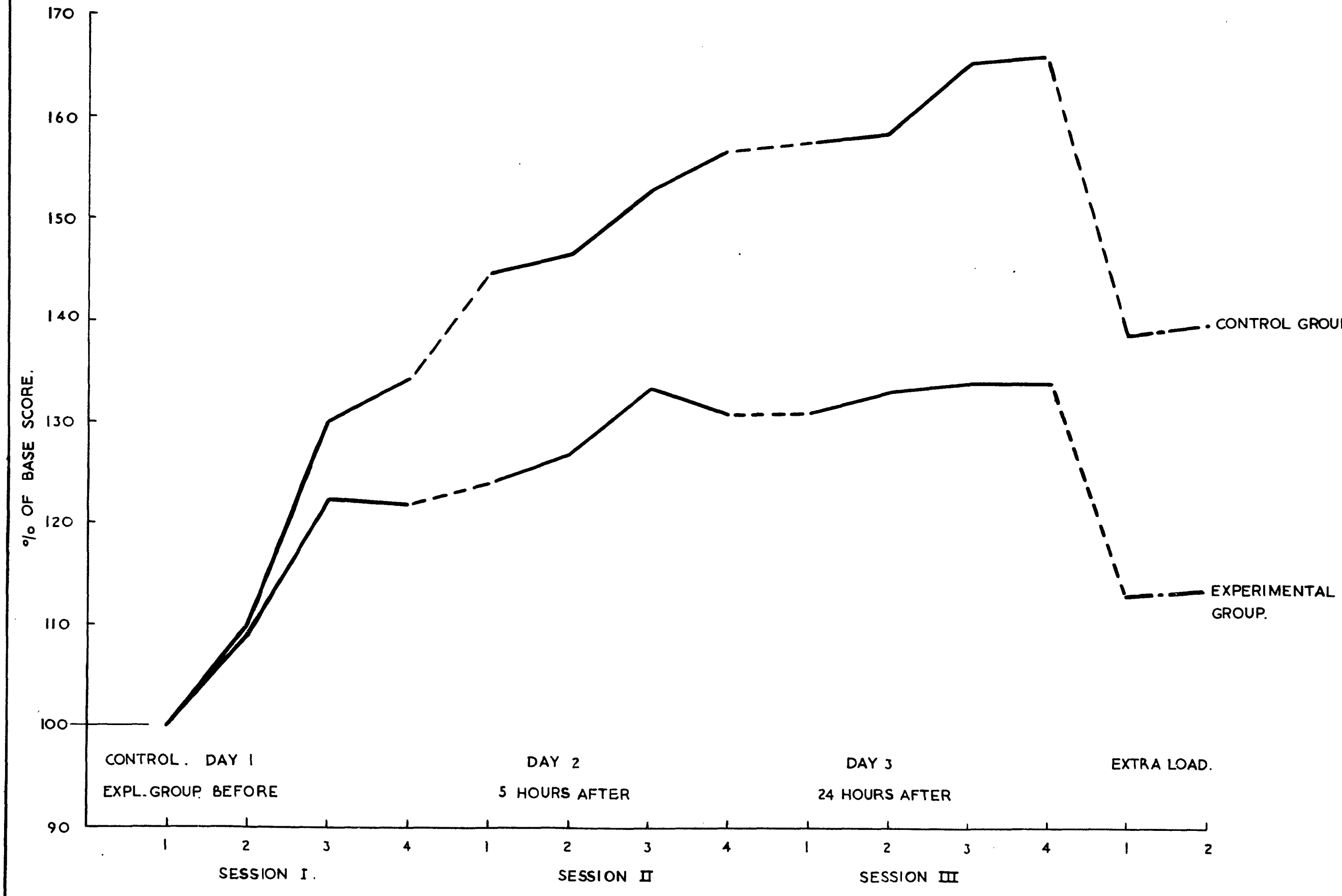


VISUAL SEARCH TEST. GRAPH. 3.

Best Available Copy



TRACK TRACER GRAPH 4.



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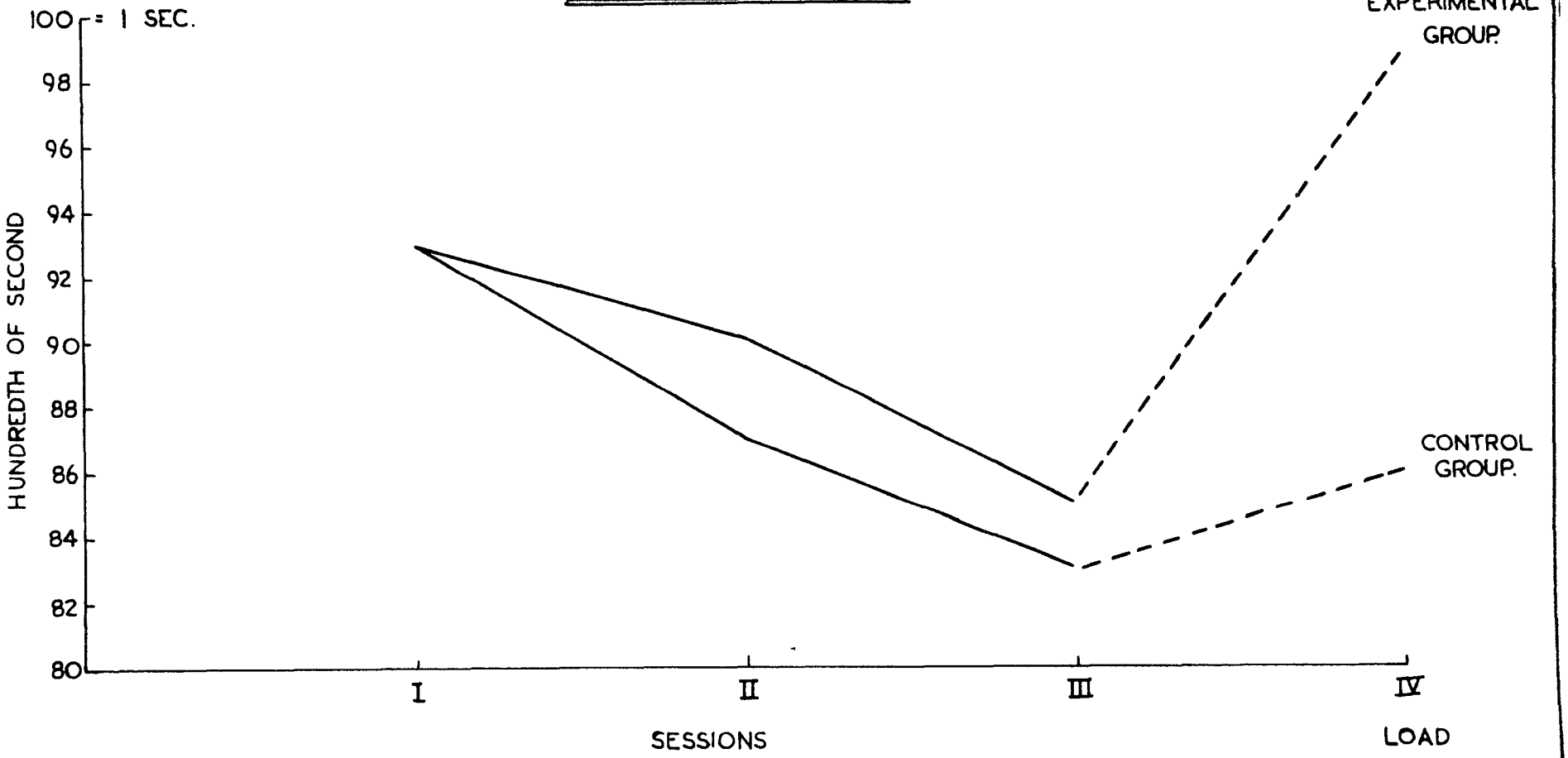
PT. 2273
DATE 28.11.52

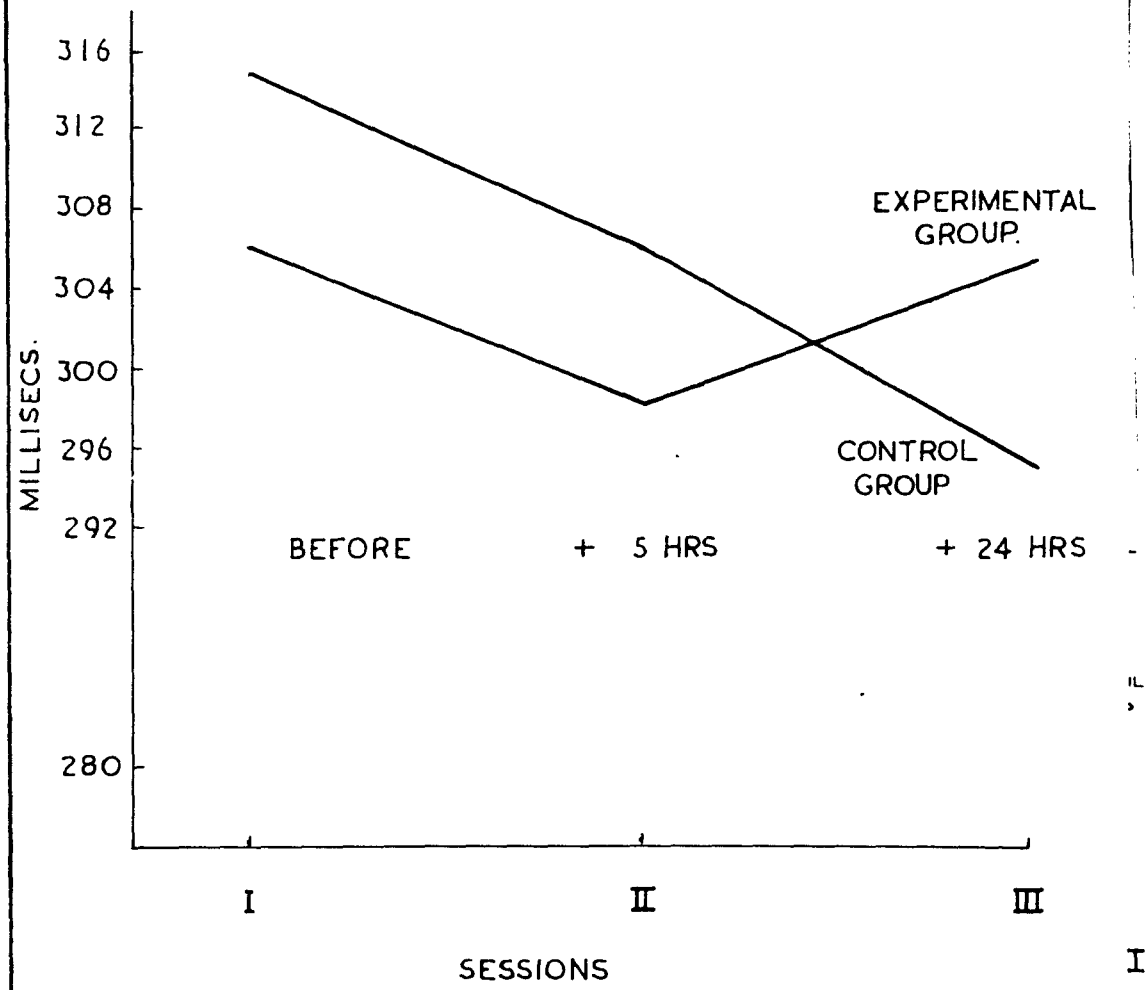
RESPONSE TIMES

LIGHT - MULTIPLE CHOICE GRAPH 5.



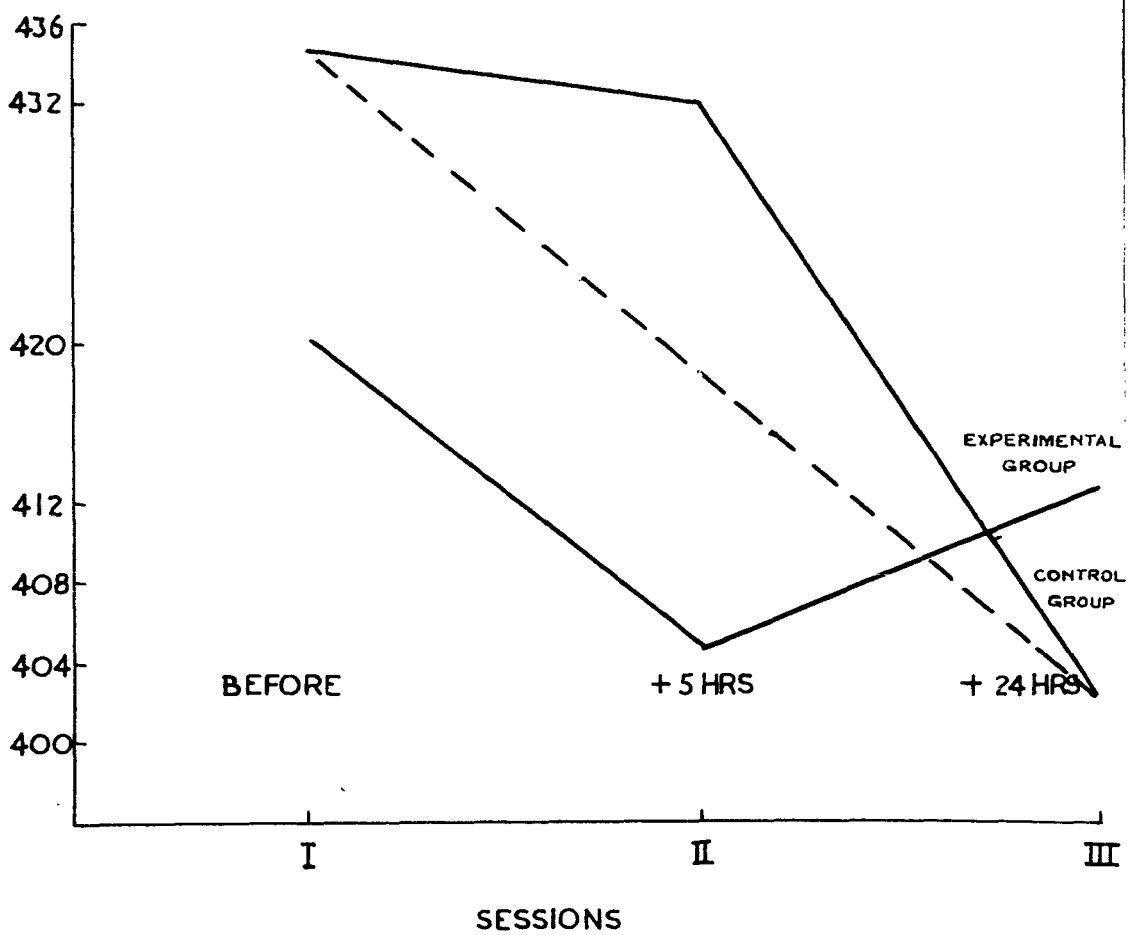
REPONSE TIMES.

AUDITORY – SIMPLE GRAPH. 6.



REPONSE TIMES.

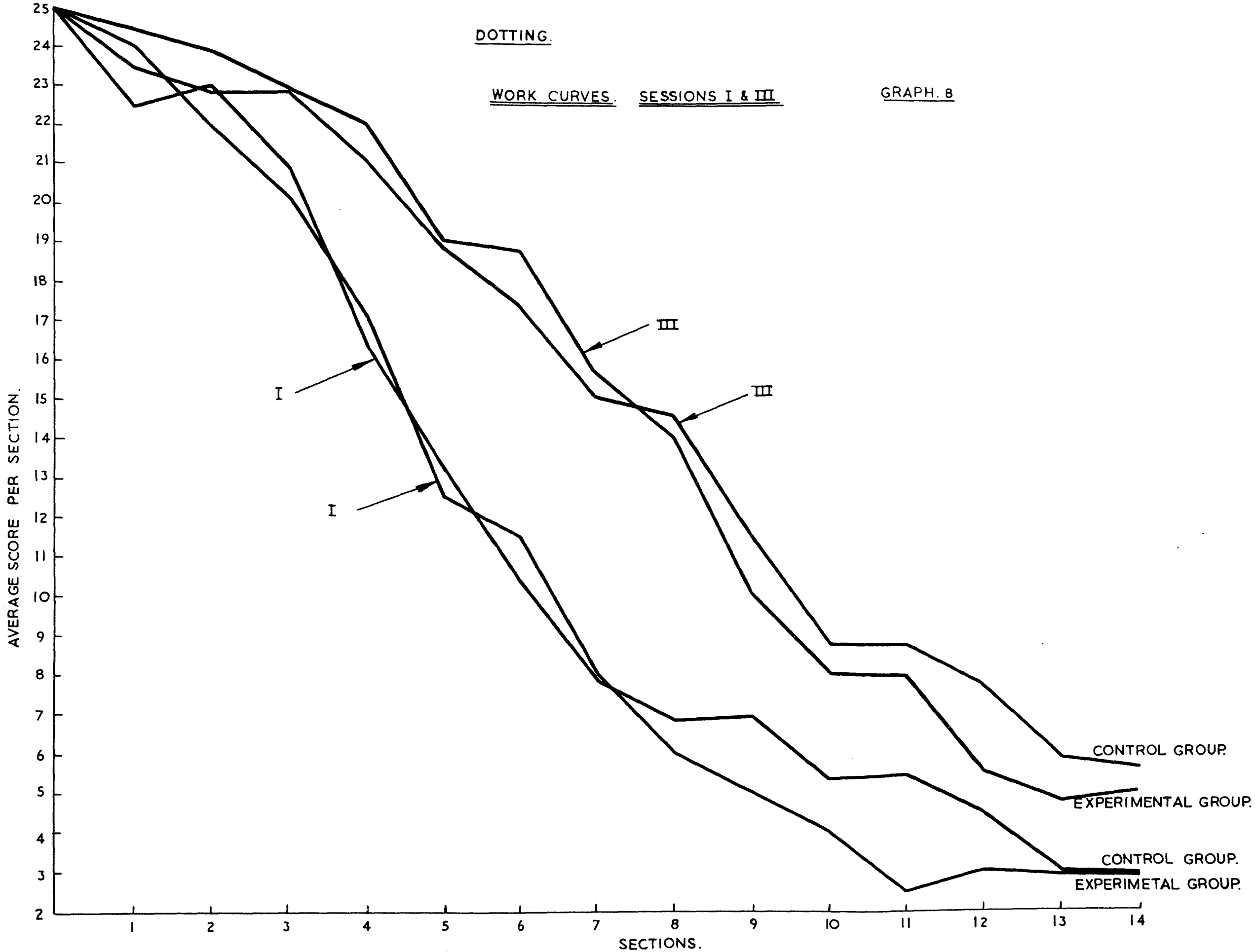
LIGHT SIMPLE. GRAPH 7.



DOTTING.

WORK CURVES. SESSIONS I & III

GRAPH. 8



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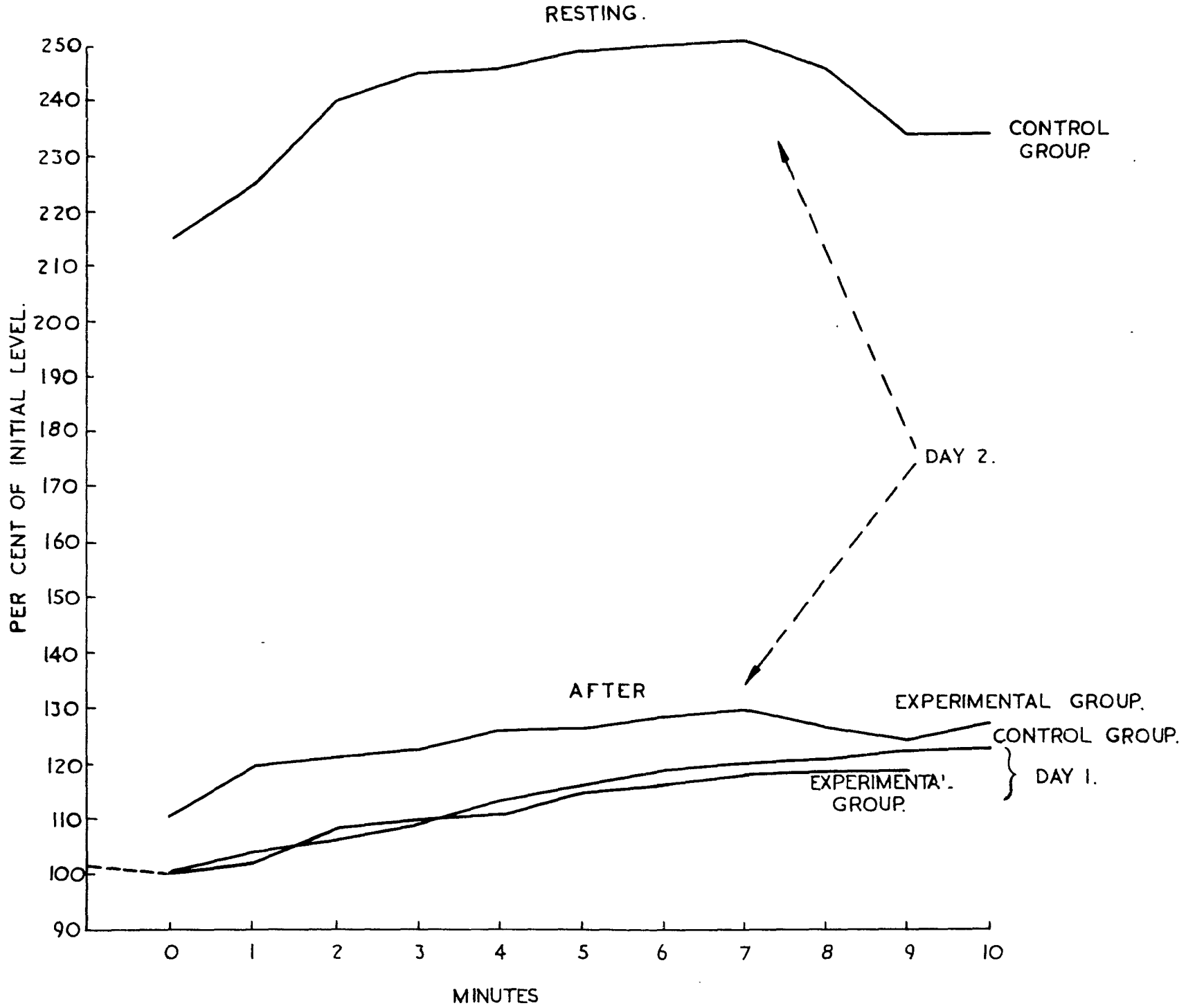
PALMAR RESISTANCE. GRAPH. 9.



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